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MAGIQ TECHNOLOGIES, INC
275 SEVENTH AVENUE
26TH FLOOR
NEW YORK, NY 10001

EXAMINER	
SHIFERAW, ELENI A	

ART UNIT	PAPER NUMBER
2136	

DATE MAILED: 01/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/706,815	VIG ET AL.	
	Examiner	Art Unit	
	Eleni A Shiferaw	2136	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/12/03, 7/12/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-11 are presented for examination.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a) because they fail to show timing/synchronization link 84 on Fig. 1 as described in the specification on page 6 lines 21-31. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Townsend (U.S. Patent Number: 5,953,421) in view of Sobolewski et al. (Sobolewski, U.S. Patent Number: 6,812,464 B1), and in further view of Petrovic (Patent No:. U.S. 6,683,958 B2), and in further view of Petrovic (US Patent Number 6,683,958 B2).

As per claim 1, Townsend teaches a method of generating calibrated optical pulses in a quantum key distribution (QKD) system, comprising:

sending first optical pulse having a fixed pulse width (Townsend Col. 3 lines 51-col. 4 lines 40) and a fixed power through a variable optical attenuator (VOA) for different VOA settings (Townsend Col. 4 lines 41-60, and col. 1 lines 51-55), and relating respective transmitted powers of the first optical pulses to respective said VOA settings (Townsend Col. 1 lines 50-57, and col. 3 lines 51-col. 4 lines 40);

setting the VOA to a maximum attenuation (Townsend Col. 1 lines 51-55);

directing second optical pulses having varying pulse widths through the VOA and relating respective transmitted powers of the second optical pulses to the respective varying pulse Widths (Townsend Abstract);

automatically setting the VOA to the calibrated attenuation setting (Townsend Col. 1 lines 50-56); and

sending the optical pulses through the VOA to create calibrated optical pulses (Townsend Col. 6 lines 57-col. 7 lines 45).

Townsend does not explicitly teach:

determining a first average power required for third optical pulse when emitted by a light source in order to obtain a second average power for each third optical pulse at a receiver of the QKD system;

determining a calibrated attenuation setting of the VOA that results each third optical pulse having the first average power;

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) that reads on determining a first average power required for third optical pulse when emitted by a light source in order to obtain a second average power for each third optical pulse at a receiver of the QKD system;

determining a calibrated attenuation setting of the VOA that results each third optical pulse having the first average power (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5);

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within Townsend because it would allow to calculate the average power and can be used in quantum cryptography (Col. 2 lines 5-9,

and col. 8 lines 64-col. 9 lines 65). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within the system of Townsend because it would determine the amount of average power needed to receive and set the attenuator to a calibrated setting for receiver to receive needed amount of power, and send the third optical pulses through the VOA to create calibrated optical pulses.

Townsend and Sobolewski do not explicitly teach hiding optical signals in using calculating the average power.

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28).

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Petrovic within the combination system of Townsend and Sobolewski because it would allow to make signal information imperceptible to observers (eavesdroppers). Therefore it would have been obvious to one having ordinary skill in the art the time of the invention was made to send first fixed pulse and power, setting VOA to a maximum attenuation, detecting second varying pulse widths, determining the average power, and send the third optical pulse to the VOA because it would hide the signal to low so no eavesdroppers can detect the signal when sending signal information from sender to receiver while the authorized receiver receives the required information efficiently.

As per claim 5, Townsend teaches a method of generating calibrated optical pulses for quantum key distribution (QKD) system, comprising:

generating first optical pulses having a fixed pulse width and fixed power using an optical radiation source (Townsend Col. 1 lines 50-57, and col. 3 lines 51-col. 4 lines 60);

passing the first pulse through a variable optical attenuator (VOA) for different VOA settings, relating respective transmitted powers of the first optical pulses to respective said VOA settings, and storing the related transmitted powers and VOA settings in a controller (Townsend Col. 1 lines 50-57, fig. 4 No. 54, and col. 3 lines 51-col. 4 lines 40);

setting the VOA to a maximum attenuation by operation of the controller (Townsend Col. 1 lines 51-55);

generating a second optical pulses having varying pulse widths using the optical radiation source and sending the second pulses through the VOA (Townsend Abstract);

relating respective transmitted powers of the second optical pulses to the respective varying pulse widths and storing the results in the controller (Townsend Col. 4 lines 41-60);

setting the VOA to a calibrated setting that would result in the receiver receiving the needed average power via third radiation pulses (Townsend Col. 1 lines 51-55); and

sending the optical pulses through the VOA to create a calibrated set of optical pulses (Townsend Col. 6 lines 57-col. 7 lines 45).

Townsend does not explicitly teach:

determining an average power needed to be incident a receiver of the QKD system;

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) that reads determining an average power needed to be incident a receiver of the QKD system;

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within Townsend because it would allow to calculate the average power and can be used in quantum cryptography (Col. 2 lines 5-9, and col. 8 lines 64-col. 9 lines 65). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within the system of Townsend because it would determine the amount of average power needed to receive and set the attenuator to a calibrated setting for receiver to receive needed amount of power, and send the third optical pulses through the VOA to create calibrated optical pulses.

Townsend and Sobolewski do not explicitly teach hiding optical signals in using calculating the average power.

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28). The rational for combining are the same as claim 1 above.

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Petrovic within the combination system of Townsend and Sobolewski because it would allow to make signal information imperceptible to observers (eavesdroppers). Therefore it would have been obvious to one having ordinary skill in

the art the time of the invention was made to send first fixed pulse and power, setting VOA to a maximum attenuation, detecting second varying pulse widths, determining the average power, and send the third optical pulse to the VOA because it would hide the signal to low so no eavesdroppers can detect the signal when sending signal information from sender to receiver while the authorized receiver receives the required information efficiently.

As per claim 7, Townsend teaches a method of generating calibrated pulses for a quantum key distribution (QKD system using a variable optical attenuator (VOA), comprising:

a) relating transmitted powers of first optical pulses passed through the VOA to respective VOA settings (Townsend Col. 1 lines 50-57, fig. 4 No. 54, and col. 3 lines 51-col. 4 lines 40);

b) relating transmitted powers of second optical pulses having varying pulse widths and passed through the VOA set at a fixed attenuation, to the respective varying pulse widths (Townsend Col. 1 lines 50-57, fig. 4 No. 54, and col. 3 lines 51-col. 4 lines 40); and

Townsend does not explicitly teach:

c) based on the relations established in a) and b) setting the VOA to provide calibrated pulses having a select average poser at a receiver based on third optical pulses output from a light source and having a select average power.

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) that reads c) based on the

relations established in a) and b) setting the VOA to provide calibrated pulses having a select average poser at a receiver based on third optical pulses output from a light source and having a select average power.

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within Townsend because it would allow to calculate the average power and can be used in quantum cryptography (Col. 2 lines 5-9, and col. 8 lines 64-col. 9 lines 65). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within the system of Townsend because it would determine the amount of average power needed to receive and set the attenuator to a calibrated setting for receiver to receive needed amount of power.

Townsend and Sobolewski do not explicitly teach hiding optical signals in using calculating the average power.

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28). The rational for combining are the same as claim 1 above.

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Petrovic within the combination system of Townsend and Sobolewski because it would allow to make signal information imperceptible to observers (eavesdroppers). Therefore it would have been obvious to one having ordinary skill in

the art the time of the invention was made to send first fixed pulse and power, setting VOA to a maximum attenuation, detecting second varying pulse widths, determining the average power, and send the third optical pulse to the VOA because it would hide the signal to low so no eavesdroppers can detect the signal when sending signal information from sender to receiver while the authorized receiver receives the required information efficiently.

As per claims 2, and 6, Townsend, Sobolewski, and Petrovic teach all the subject matter as described above. In addition Townsend teaches the method, wherein the receiver of the QKD system is connected to an optical radiation source by an optical channel, and including:

disconnecting the optical channel downstream of the VOA (Townsend Fig. 4 No. 55, and 47) and

reconnecting the optical channel prior to creating optical pulses (Townsend Fig. 4 No. 55, and 47, and col. 6 lines 21-25).

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) to measure the transmitted powers of the first optical pulses using a power meter connected to an open end of the optical channel downstream of the VOA. The rational for combining are the same as claim 1 above.

As per claim 3, Townsend, Sobolewski, and Petrovic teach all the subject matter as described above. In addition Townsend the method, wherein the receiver has an integration time T1, the third optical pulses have a repetition rate r, a pulse width w, and further including ensuring calibration by:

periodically measuring the average number of photons m per third optical pulse using a single-photon detector (Townsend Col. 9 lines 7-50); and

Townsend and Sobolewski do not explicitly teach if the measured average number of photons m per third optical pulse is not equal to a desired average number (msubD) of photons per pulse; then changing at least one of: (i) the integration time T1, (ii) the pulse repetition rate r, (iii) the optical pulse width w, and (iv) the VOA setting,

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28). The rational for combining are the same as claim 1 above.

As per claim 4, Townsend, Sobolewski, and Petrovic teach all the subject matter as described above. In addition, the method, further including: comparing the measured average number of photons m per third optical pulse to a threshold average number of photons per optical pulse msubT to ensure quantum security of the QKD system (Townsend Col. 9 lines 7-50, and Petrovic Col. 14 lines 35-col. 15 lines 28). The rational for combining are the same as claim 1 above.

Claims 8-9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bennett (U.S. Patent Number: 5,307,410) in view of Sobolewski et al. (Sobolewski, U.S. Patent Number: 6,812,464 B1), and in further view of Petrovic (US Patent Number 6,683,958 B2).

As per claim 8, Bennett teaches a one-way calibrated QKD system comprising:

First and second stations optically coupled via an optical channel (Bennett Col. 3 lines 66-col. 4 lines 35);

an optical radiation source location in the first station and capable of generating optical pulses that travel in the optical channel between the stations (Bennett Abstract);

a variable optical attenuator (VOA) arranged in the first station downstream of the optical ration source (Bennett Col. 2 No. 32);

a VOA driver operatively couple to the VOA (Bennett Col. 4 lines 49-68);

an electrical meter operatively coupled to the VOA (Bennett Col. 4 lines 36-42); and

a controller operatively coupled to the VOA (Bennett Fig. 2 No. 40), the VOA driver (Bennett Col. 4 lines 49-68), the optical radiation source and the electrical meter (Bennett Col. 4 lines 36-42, and col. 11 lines 25-32); and

VOA is set during the distribution of cryptography (Bennett Col. 4 lines 49-68) that reads on wherein the VOA is automatically set by the controller using a calibration table, and

Bennett does not explicitly disclose an average power expected at a receiver in the second station in order to produce calibrated optical pulses from the optical pulses output by the optical radiation source.

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) that reads an average power expected at a receiver in the second station in order to produce calibrated optical pulses from the optical pulses output by the optical radiation source.

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within Bennett because it would allow to calculate the average power and can be used in quantum cryptography (Col. 2 lines 5-9, and col. 8 lines 64-col. 9 lines 65). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within the system of Bennett because it would determine the amount of average power needed to receive and set the attenuator to a calibrated setting for receiver to receive needed amount of power.

Bennett and Sobolewski do not explicitly teach hiding optical signals in using calculating the average power.

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28).

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Petrovic within the combination system of Bennett and Sobolewski because it would allow to make signal information imperceptible to observers (eavesdroppers). Therefore it would have been obvious to one having ordinary skill in the art the time of the invention was made to send first fixed pulse and power, setting VOA to a maximum attenuation, detecting second varying pulse widths, determining the average power, and send the third optical pulse to the VOA because it would hide the signal to low so no

eavesdroppers can detect the signal when sending signal information from sender to receiver while the authorized receiver receives the required information efficiently.

As per claims 9 and 11, Both Bennett and Sobolewski teach all the subject matter as described above. In addition, the QKD system, wherein the optical pulses emitted by the optical radiation source have a pulse width in the range between about 10ps and about 10ns, and an optical pulse rate between about 100KHz and about 20MHz (Sobolewski Col. 4 lines 1-13, and Bennett Col. 11 lines 24-32). The rational for combining are the same as claim 8

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gisin et al. (Gisin U.S. Patent No.: 6,438,234 B1) in view of Sobolewski et al. (Sobolewski, U.S. Patent Number: 6,812,464 B1), and in further view of Petrovic (US Patent Number 6,683,958 B2).

As per claim 10, Gisin teaches a two-way calibrated QKD system comprising:

first and second station optically coupled via an optical channel (Gisin Col.2 lines 32-55);

an optical radiation source located in the first station and capable of generating optical pulses that travel in the optical channel between the stations (Gisin Abstract);

a receiving detector located in the first station (Gisin Fig. 2 No. 23);

a variable optical attenuator (VOA) arranged in the second station (Gisin Col. 5 lines 63-col. 6 lines 27);

a VOA driver arranged in the second station and operatively couple to the VOA (Gisin Col. 5 lines 63-col. 6 lines 27);

an electrical meter arranged in the second station and operatively coupled to the VOA (Gisin Col. 5 lines 63-col. 6 lines 27); and

a controller operatively coupled to the VOA, the VOA driver, the optical radiation source and the electrical meter (Gisin Col. 5 lines 63-col. 6 lines 27, and col. 7 lines 1-7); and

VOA is set during the distribution of cryptography (Bennett Col. 4 lines 49-68) that reads on wherein the VOA is automatically set by the controller using a calibration table stored therein, and

Gisin does not explicitly disclose an average power expected the receiving detector in the first station to produce calibrated optical pulses from the optical pulses output by the optical radiation source and sent to the second station to be modulated and returned to the first station.

However Sobolewski discloses performing average power in quantum cryptography (Sobolewski Abstract, col. 8 lines 64-col. 9 lines 65, and Fig. 5) that reads an average power expected the receiving detector in the first station to produce calibrated optical pulses from the optical pulses output by the optical radiation source and sent to the second station to be modulated and returned to the first station.

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within Gisin because it would allow to calculate the average power and can be used in quantum cryptography (Col. 2 lines 5-9, and col. 8 lines 64-col. 9 lines 65). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made to employ the teachings of Sobolewski within the system of Gisin because it would determine the amount of average power needed to receive and set the attenuator to a calibrated setting for receiver to receive needed amount of power.

Gisin and Sobolewski do not explicitly teach hiding optical signals in using calculating the average power.

However Petrovic discloses by hiding signals or by setting signals to low, the receiver of the information or signal can efficiently receive the required transmitted information while protecting eavesdroppers from detecting the low signal information transmitted from sender (Petrovic Col. 14 lines 35-col. 15 lines 28).

Therefore it would have been obvious to one ordinary skill in the art at the time of the invention was made to employ the teachings of Petrovic within the combination system of Gisin and Sobolewski because it would allow to make signal information imperceptible to observers (eavesdroppers). Therefore it would have been obvious to one having ordinary skill in the art the time of the invention was made to send first fixed pulse and power, setting VOA to a maximum attenuation, detecting second varying pulse widths, determining the average power, and send the third optical pulse to the VOA because it would hide the signal to low so no eavesdroppers can detect the signal when sending signal information from sender to receiver while the authorized receiver receives the required information efficiently.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eleni A Shiferaw whose telephone number is 571-272-3867. The examiner can normally be reached on Mon-Fri 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz R Sheikh can be reached on 571-272-3795. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eleni Shiferaw
Art Unit 2136
December 21, 2004

EMMANUEL L. MOISE
PRIMARY EXAMINER